

## **STRENGTH AND POWER OF THE LOWER LIMBS AND THE EFFECTIVENESS OF CHANGE OF DIRECTION (COD) IN TEAM SPORT GAMES.**

**Key words:** COD, soccer, basketball, post-activation performance enhancement, agility

Change of Direction (COD) is a key mode of movement in team sports games, especially in soccer, handball, volleyball, and basketball (Michailidis et al., 2020; Katsumata and Aoki, 2021; Scanlan et al., 2021), with linear sprinting accounting for approximately 30% of game time (McInnes et al., 1995; Ben Abdelkrim et al., 2007). Consequently, researchers and coaches are increasingly focusing on the COD efficiency during the training process. Various tests have been proposed to assess COD ability, primarily distinguished by variables such as angle of change, number of changes, distance, and type of movement during the test. COD is a complex motor skill that requires acceleration, deceleration, and reacceleration, thus cannot be defined by a single ability or feature. Accordingly, the effective implementation of advanced methods and training programs aimed at improving COD skills requires establishing the relationship between COD indicators and lower limb strength or power.

The aim of the first study presented in this collection of articles was to determine the relationship between the level of power evaluated during the seated leg press (LP) and sprint 5 and 20m time, as well as the time obtained in COD tests, namely the 'L' test and the 'ZigZag' test. The second objective of the study was to examine the relationship between the time obtained in the modified t-test (MAT) and the LP power output, and the maximum isometric lower limb abduction and adduction strength tests, 20m sprint time, and selected kinematic variables of vertical jumps (countermovement jump without arm swing [CMJ] and drop jumps [DJ]). Consequently, the aim of the third study was to verify whether the activation complex designed based on the results provided from previous studies would have a significant acute impact on the results of the MAT test. The hypotheses were as follows: i) the LP power output will be negatively correlated with sprint time and 'L' and 'ZigZag' test time, and the interlimb asymmetry in power output will be positively correlated with the COD test time; ii) the LP power output, the CMJ and DJ relative power output, and the maximum isometric lower limbs abduction and adduction strength would be negatively correlated with the MAT test time; iii) a high-intensity activation complex performed unilaterally (split squat and depth jump to lateral hop) will acutely reduce MAT test time.

The Witty Gate photocells (Microgate, Bolzano, Italy) were used to measure the time in the selected running tests. The participants started from a standing position, with the foot positioned 0.5m behind the starting line. Before performing the running tests, participants were instructed to complete the task as quickly as possible. The tests were always performed twice with a 3-minute rest interval between repetitions, and the better time was used for analysis. During each attempt, the participants started when they were ready to eliminate the influence of reaction time. A force platform (Force Decks, Vald Performance, Albion, Australia; sampling frequency 1000Hz) was used for jump performance measurements. CMJ was performed from a standing position, with the lower limbs at shoulder width and the hands on the hips. The participants were asked to perform a squat and immediately perform a maximum CMJ, with the final position the same as the starting position. DJ, was performed from a 60 cm box, with the participants informed to initiate the jump with a free fall (not a jump) from the box, and then after contacting the ground, jump as quickly and as high as possible. Two trials were performed.

In the first study, the sample consisted of soccer players, and in studies 2 and 3, basketball players participated. The main finding of the first study was the lack of relationships between the 'L' and 'ZigZag' tests' time and the LP power output and sprint time over a distance of 5 and 20 m. The second study provided evidence that the indicators of lower limb strength and power could significantly explain the MAT test time. The coefficient of determination showed that 93% of the MAT time initiated to the left could be explained by a model including the left lower limb LP maximum power output, maximum isometric left lower limb adduction strength, and the CMJ height. On the other hand, 83% of the MAT time initiated to the right could be predicted by the maximum isometric left lower limb adduction and abduction strength. The correlations between the indicators of lower limb strength and power and MAT time initiated on the left and right sides were similarly significant, except for the CMJ height, which was strongly negatively correlated with MAT initiated to the left. The third study, which evaluated the effectiveness of two activation complexes consisting of i) 2 sets of 4 repetitions of bilateral squats at 80% one-repetition maximum and 10 DJ, and ii) 2 sets of 2 repetitions of split squats on each limb at 80% one-repetition maximum and 5 depth jumps to lateral hop on each limb, showed no significant impact on the subsequent MAT test time in basketball players.

The presented research cycle showed that the time obtained in the MAT test, but not in the 'L' and 'ZigZag' tests, may be significantly related to selected lower limb strength and power

indices. While such a combination of exercises does not lead to an acute significant improvement in MAT test results.